Faculty Working Papers

SOME EFFECTS OF UTILITY REGULATION ON FIRM OPERATING AND FINANCIAL STRATEGIES

Cheng F. Lee and Walter J. Primeaux, Jr.

#421

College of Commerce and Business Administration
University of Illinois at Urbana-Champaign

FACULTY WORKING PAPERS

College of Commerce and Business Administration

University of Illinois at Urbana-Champaign

July 20, 1977

SOME EFFECTS OF UTILITY REGULATION ON FIRM OPERATING AND FINANCIAL STRATEGIES

Cheng F. Lee and Walter J. Primeaux, Jr.

#421

SOME EFFECTS OF UTILITY REGULATION ON FIRM OPERATING AND FINANCIAL STRATEGIES

by

Cheng F. Lee
Associate Professor of Finance
The University of Illinois at Urbana-Champaign

and

Walter J. Primeaux, Jr.
Professor of Business Administration
The University of Illinois at Urbana-Champaign

ABSTRACT

This paper shows that different degrees of regulation affect electric utility firm's operating and financial strategies.

The analysis also provides a potential approach for testing the Averch-Johnson effect using financial information which has been neglected until this time.

SOME EFFECTS OF UTILITY REGULATION
ON FIRM OPERATING AND FINANCIAL STRATEGIES

I. INTRODUCTION

Although it is important to examine the effect of utility regulation on the financial behavior of firms, one important avenue of inquiry has remained unexplored. That is, regulation is not a homogeneous commodity and all regulated firms are not subjected to the same degree of regulation. This condition raises an important question. That is, if regulation differs according to the type of regulatory regime faced by the firm, how does each firm adjust its capital structure and operating strategy so as to minimize the adverse impact of that regulation on the firm's performance. That inquiry is the main purpose of this study; that is, do differences in regulatory regimes faced by regulated firms affect the firm's capital structure and operating strategy?

The plan of this paper is as follows. In the second section, previous studies are reviewed. In the third section, the theoretical base for this paper is developed. The fourth section presents empirical studies developed to test the relevant hypotheses. Finally, the results of this paper and conclusions are summarized.

II. PREVIOUS STUDIES

The landmark study by Modigliani and Miller (M & M) (1958) examined electric utility firms and discussed risk class of securities caused by the variability of earnings streams. The original M & M study as well as Modigliani and Miller's (1963 1965 and 1966) subsequent studies do not examine the effect of type of regulatory regime on the risk class of securities.

Boness and Frankfurter (1977) are somewhat critical of M & M and question whether risk class should be associated with industry. They examine what they term "the believed-to-be most homogeneous of industries, electric utilities."

They conclude that the results of their tests are convinvingly at variance with the notion that the electric utility industry is a homogeneous population. They conclude:

> Simply the M & M choice, as that of many others' using the definition of electric utilities (or any other "industry" for that matter) as a surrogate for risk class, was a poor choice.

Hite (1977) theoretically investigated the relationship among leverage, output effects and the M & M theorems. He argued that output, investment and financing decisions must be optimized simultaneously. While the Hite study is interesting, it does not explicitly address the questions of how operating decisions and operating strategy are affected by utility regulation.

In another landmark study, Eiteman (1962) examined the permitted and earned rates of return of fifteen Bell Telephone companies in the 1950–1959 period. Eiteman found that "...actual rates of return to book value of securites (that is, to original cost)...have been highest for companies in the reproduction-cost jurisdictions and lowest for the companies in the original-cost jurisdictions.

Pike (1967), using electric utility data for 1961-1963 found a mean rate of return of 6.38 percent on net plant in original cost jurisdicitons and 6.63 percent where other valuation methods were used.

Petersen (1976) found that the allowed rates of return and the realized rates of return were higher for fair value firms than those in original cost jurisdictions.

The last three studies recognize that different types of regulation may cause differences in earnings streams; yet, this possibility was ignored by the M & M and Boness and Frankfurter studies. Moreover, although the latter studies do recognize the effect of different degrees of regulation on the earnings stream, these studies do not examine the effect of the different regulatory regimes on the risk class, the adjustments made to capital structure, and operating strategy as firms attempt to neutralize or offset the effect of utility regulation on their

earnings. Moreover, these different regulatory effects will obviously affect the homogeneity of a sample of electric utility firms.

III. THE THEORY

The rate base is defined as the gross valuation of public utility property, less depreciation. In electric utility rate making, the rate base is considered an important variable because it is at the core of the rate determination process. The state regulatory commission must also establish a rate of return allowable on the rate base;[1] then that rate is applied to the rate base to determine the return amount which the utility may earn. Then, the specific rate schedules for the utility must be constructed. This indicates, therefore, that both the rate base and the rate of return affect the return amount which the utility earns from selling its services. The rate base is determined on the basis of orignial cost, fair value, or reproduction cost depending upon the state in which the firm is situated. State law prescribes which method is to be used in a given state.

There is a distinct difference between original cost, fair value, and reproduction cost methods of determining the rate base. Garfield and Lovejoy (1964, p. 60) explain that in the original cost method the property is valued at its cost when it was first used in a public utility application. The procedure is historical, in a sense, because the current market valuation of the equipment is irrelevant to its value for rate making.

Garfield and Lovejoy (1964, p. 59) explain that in fair value valuation of a rate base the value is determined by considering three factors: "(a) The actual cost of the property; (b) the present value of construction...; and (c) other matters generally taken to represent various intangibles." This technique clearly provides for a consideration of the current cost of equipment in determining the value of a rate base for rate making purpose.

The reproduction cost new less depreciation rate base method of valuation involves "...the cost of duplicating the existing plant at recent or present prices,

less depreciation." Garfield and Lovejoy (1964, p. 63). This procedure involves a consideration of construction costs and price level adjustments. This approach, therefore, considers changes in the value of money.

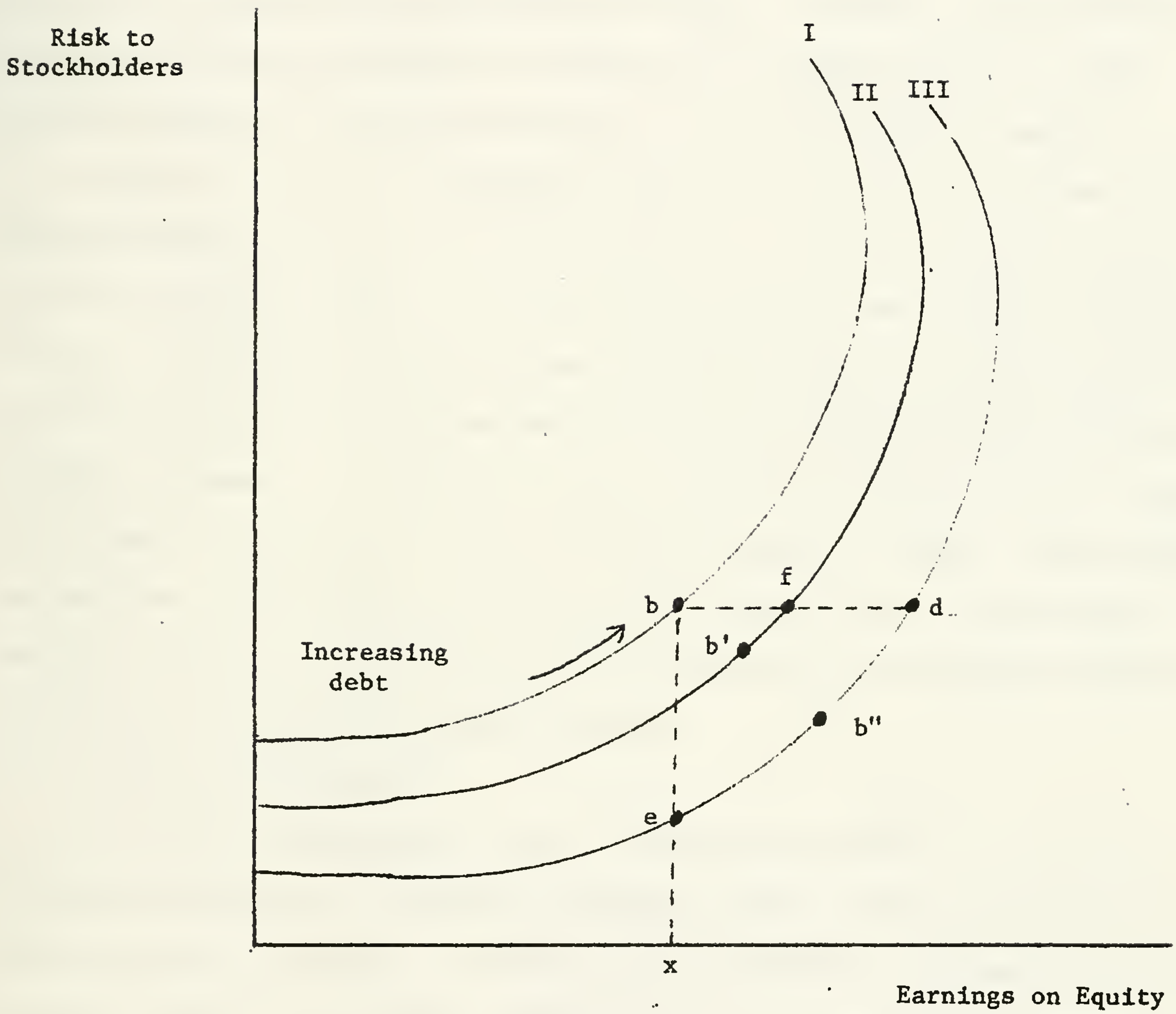
There are arguments advanced for and against the use of each of these three methods of rate base valuation, see Garfield and Lovejoy (1964, pp. 58-65). The facts remain, however, that one of these methods is used in each state regulatory jurisdiction. It is obvious (from footnote 1) that each of these three methods of rate base determination will permit the firm to generate a different earnings streams or revenue requirement. Realized rates of return should be highest for reproduction cost jurisdictions and lowest for firms in original cost jurisdictions. Firms in fair value jurisdictions should generate rates of return in between original cost and reproduction costs.[2]

The different rates of return caused by different rate base methods causes different earnings streams and consequently affects the risk class of securities.[3] Actually, a different level of business risk is caused by the different regulatory regimes because of the different earnings streams.

In Figure 1, curves I, II, and III represent the relationship between earnings on equity and risks to stockholders for the different regulatory regimes. Curve I represents the highest level of business risk and III the lowest; therefore, since original cost regulation yields lower rates of return, I represents that regime. Since reproduction cost regulation yields the highest returns, III represents that regime and II represents fair value which yields intermediate level of returns. The same level of business risk is associated with any point along a given curve, but as mentioned before, I represents higher business risk than II, etc.

The firms controlled by fair value and reproduction cost regimes enjoy decreased riskiness (business risk) which allow them to increase their debt (and thus increase return on equity), without increasing total risk to stockholders. (see Figure 1, b, f and d). Thus, the fair value and reproduction cost firms are

Figure 1



Adapted from: Gloria G. Hurdle "Leverage, Risk, Market Structure and Profitability," Review of Economics and Statistics, Vol. LVI, No. 4 , p. 479.

advantaged and have earnings risk curves somewhat like II and III in Figure 1.[4]

If one compares the three curves at the same debt level, that is, points b, b', and b", the financial risks associated with the same debt will be the same for the three regulatory regimes, but as mentioned earlier the business risk will be lower for the II and III curve. Consequently, the total risk to stockholders of firms operating in those regulatory regimes will be lower. Moreover, the earnings in the fair value and reproduction cost regimes will be higher because of their favored treatment by regulators and because of their lower cost of capital.

Since b, b', and b" all represent the same debt levels, it is obvious that firms regulated by fair value and reproduction cost regimes are able to increase their debt level more readily than those in the original cost regimes. Moreover, there are good economic reasons why such adjustments should be made. Consequently, the differences in regulatory regimes causes electric utility firms to modify their capital structures. In addition, it is also possible for utility firms to change their operating strategy to react to different regulation regimes. In the following section data from fifty-nine electric utility firms are used to develop some empirical studies which examine the effect of regulation on operating strategy and the effect of regulation on capital structure.

IV. EMPIRICAL INVESTIGATION[5]

Data from fifty-nine electric utility firms during 1958-1975 are used to investigate the effects of different regulatory regimes on the operating and financial strategy of firms in the electric utility industry. The company list in Appendix A shows that the sample consisted of 34 firms regulated by original cost rates base jurisdictions; 19 firms regulated by a fair value rate base jurisdiction, and 6 firms from reproduction cost rate base jurisdictions. The sample was selected from the electric utility firms listed in the Compustat utility tape. Firms operating in more than one state were eliminated

because they were regulated by more than one regulatory regime. This procedure avoided the joint effect on a single firm caused by different rate base methods being used in different states. Holding companies were also excluded. Some electric firms also sell natural gas; therefore, within the sample for each rate base method, roughly the same proportion of firms sold both gas and electricity as those selling only electricity. This approach was used to reduce the market power problem caused when firms face no competition from substitute fuel when the sell both gas and electricity in a single market. To reveal the dynamic nature of the impact of different regulatory regimes, data for 18 years, 1958-1975, were used in the analysis.

The impact of different regulation on the operating strategy of the electric utility firms was evaluated by examining the degree of operating leverage. Following Hunt (1961), Mao (1969), and Weston and Brigham (1975) the degree of operating leverage (DOL) can be defined as:

$$DOL = \frac{P(Q-V)}{P(Q-V)-FC} \qquad (1)$$

where: P = market price per unit of product

V = variable cost per unit of product

Q = total quantity of goods sold

FC = total fixed cost

Based upon the break-even formula, DOL can be rewritten as:

$$DOL = \frac{1}{1 - \frac{Q^*}{Q}} \qquad (2)$$

where $Q^* = \frac{FC}{P-V}$ is the break-even point. Equations (1) and (2) indicate that the magnitude of DOL is essentially determined by the percentage of idle capacity. If firm A's DOL is higher than the DOL of firm B, this implies that the percentage of profit increase from a one percent increase of net sales for firm A will be

higher than that of firm B. However, if the operating and financing conditions are the same for both firms A and B, then the above-mentioned difference is essentially caused by firm A having a higher percentage of unutilized capacity. In a sense, a high percentage of unutilized capacity implies high capital labor ratio.

Averch and Johnson (1962) have investigated the behavior of the firm under regulatory constraint. Using profit maximization as the motivation, they argue that regulation will generally encourage a firm to employ a more capital intensive production process. In this study, the DOL's of firms operating in different regulatory regimes were used to test whether different degree of regulation induce an electric utility firm to maintain different levels of idle plant capacity.[6]

DOL's were calculated for fifty-nine firms during 1958-1975. Analysis of variance statistical technique was used to test whether the DOL's for firms operating in fair value, original cost, and reproduction cost regulatory regimes were significantly different.

The F values listed in Table 1 reveal that the DOL's are significantly different among different regulation regimes at the 5%, 10% or 15% significant level for 14 out of 18 years. The average DOL ($\overline{DOL}$) figure listed in Table 1 shows that the DOL's associated with fair value valuation are always higher than those of original cost regimes. This implies that firms under fair value regulation would tend to maintain higher idle capacity than firms under original cost jurisdictions. This may reflect a differential response to the Averch-Johnson effect caused by differences in regulatory regimes. The rationale for this behavior is rather straightforward. According to Averich and Johnson (1962), regulation would encourage a firm to employ a more capital intensive process. Since the fair value method causes the rate base to be higher than the original cost method, the more liberal approach encourages even greater excess capacity than

the original cost methods. The relationship of the average DOL of reproduction cost with the other groups in less conclusive (see Table 1); perhaps, however, a problem exists because of the small sample available for this class of firms (only 6 firms).

Two different measures of leverage were used to investigate the impact of different degrees of regulation on electric utility company's financing strategy (or capital structure). Following Krainer (1977) and Miller and Modigliani (1958, 1963) both the income statement and the balance sheet measures of leverage were used to make this empirical test. The first leverage measure is defined as total interest charges of firm i (Fi) divided to total returns for firm i (Xi) [Fi/Xi]; the second leverage measure is defined as total book value of long-term debt for firm i (Di) divided by total book value of asset (Ai) [$\frac{Di}{Ai}$]. The analysis of variance technique was again used to determine the extent of differences in leverage among firms operating in the three different regulation regimes. Table II reveals that there were really no differences in leverage among firms operating in the three different regimes for all 18 years when the Di/Ai definition is used. However, if the Fi/Xi definition is used, there are significant differences in the leverage among firms in three different regimes for 9 years. It is appropriate to consider the relative advantages between the two different definitions of leverage, $\frac{Di}{Ai}$ and $\frac{Fi}{Xi}$.[7]

Miller and Moligliani (1958) defined leverage as the ratio between market value of debt and market value of equity. In their 1963 AER paper, they argued that $\frac{Fi}{Xi}$ can be used as an alternative leverage measure.[8] It is clear that the definition of $\frac{Fi}{Xi}$ is much closer than $\frac{Di}{Ai}$ to M & M's original theoretical concept of leverage. Krainer (1977) discussed the advantage of using $\frac{Fi}{Xi}$ as leverage measure. He considers Xi a more natural measure for bond holders since a going concern's operating income, X, is the ultimate source for fulfilling the bond contract. In addition, Krainer argued that over time changes in the interest rate itself might be concealed in the debt-equity ratio.

Table II also shows that the $\overline{D}/A$ is very stable over time and the $\overline{D}/A$'s for the electric utility firm are around forty-five percent. This figure is nearly identical to the Bell System's optimal capital structure.[9] In the parenthesis associated with overall $\overline{D}/A$ is the $\overline{D}/A$ with current debt as part of total debt. The results show that current debt of electric utility firms is approximately 2-3 percent. The relative stable $\overline{D}/A$ over time can be used to explain parts of Krainer's (1977) findings and explain the dynamic relationship between the interest rate and capital structure. Table IV shows that firms, except for 1975, with original cost regulation regimes have the highest $\frac{\overline{Fi}}{Xi}$, and the $\frac{\overline{Fi}}{Xi}$'s associated with fair value regimes is higher than those of firms with replacement cost regimes for 12 out of 18 years. If interest charges are similar for all three regimes, then the different $\frac{\overline{Fi}}{Xi}$ may well be because regulation for reproduction cost regimes is more liberal than that of firms under either original cost or fair value regimes; and the regulation for fair value is more liberal than that of original cost regimes, as found by Peterson (1976).[10] Finally, it is worth noting that the $\frac{Fi}{Xi}$ are increasing over time. This tendency may be because the interest rates faced by the electric utility companies are increasing over time; interestingly, even the $\frac{\overline{D}}{A}$ is stable over time (see Table III). This may imply that the financial risk for firms in the utility industry is generally increasing over time. Incidentally, data show that most of the long term debt of the utility industry is mortgage debt. However, the implication of mortgage debt (secured debt) optimal capital structure and bankruptcy risk has been explored by Scott (1977).

The analyses of this section reveal that the different degrees of regulation, as reflected by the different regulatory regimes, do cause some adjustments by electric utility firms to their operating and financing strategy. This conclusion can be used to explain Boness and Frankfurter's findings about the heteroscedastic nature of utility firms within the utility industry. Miller and Modigliani's (1966) sample used by Boness and Frankfurter are listed in appendix C. The regulation regime associated with each firm is also indicated. This classification shows

that there exists at least three different regulatory regimes faced by M & M's sample firms. Some firms in M & M's and our sample produced both electricity and natural gas. From the market power theory developed by Hurdle (1975), it can be argued that firms producing both electricity and natural gas will have market power to generate more profit than those firms selling only one of these products. This is an additional reason for Boness and Frankfurter's findings; market power differences make firms dissimilar, even if they are in the same industry.

V. SUMMARY AND CONCLUSIONS

This paper has shown that different degrees of regulation do affect electric utility firm's operating and financing strategies. The degree of operating leverage measure is used as an index of operating strategy; both balance sheet and income statement leverage ratios were used as indices of financing strategy. The results of this analysis were also used to explain Boness and Frankfurter's findings concerning the heteroscedastic nature of utility firms within the utility industry.

This study also provides a potential approach for testing the Averch-Johnson effect using financial information which has been neglected until this time.

TABLE I

Average DOL and the F values

	$\overline{DOL}$				F statistics
	Overall	Group 1	Group 2	Group 3	
1958	2.3325	2.2463	2.4472	2.3867	2.8179*
1959	2.2922	2.2213	2.3988	2.3574	2.7447*
1960	2.2804	2.2020	2.3856	2.3910	2.9418*
1961	2.2867	2.2001	2.3996	2.4169	3.1125**
1962	2.2665	2.1998	2.3627	2.3389	1.6630
1963	2.2517	2.1683	2.3848	2.3027	2.7558*
1964	2.2274	2.1385	2.3682	2.2852	3.3436**
1965	2.1757	2.0935	2.2982	2.2538	3.2999**
1966	2.1299	2.0569	2.2185	2.2633	2.8257*
1967	2.0967	2.0343	2.1682	2.2241	2.0121*-
1968	2.1063	2.0414	2.1796	2.2426	2.2828*-
1969	2.0569	1.9945	2.1414	2.1427	2.1569*-
1970	1.9864	1.9458	2.0635	1.9729	1.3475
1971	1.9776	1.9515	2.0414	1.9237	.8723
1972	1.9643	1.9294	2.0608	1.8567	2.2110*-
1973	1.9717	1.9493	2.0685	1.7920	2.4049*
1974	1.9512	1.9239	2.0613	1.7570	1.9150
1975	1.9716	1.9499	2.0851	1.7343	2.6945

** Significant at 5% level

* Significant at 10% level

*- Significant at 15% level

Table II

Average Value of $\frac{Fi}{Xi}$ and the F statistics

	($\overline{Fi}$/Xi)				F statistics
	Overall	Group 1	Group 2	Group 3	
1958	17.34%	17.90%	16.53%	16.77%	.5270
1959	17.03	17.59	16.42	15.77	.4317
1960	16.98	17.38	16.89	14.97	.6248
1961	17.29	18.12	16.67	14.54	2.6380*
1962	17.02	17.80	16.43	14.42	2.3609*
1963	16.94	17.58	16.76	13.90	1.9551*-
1964	16.88	17.68	16.59	13.23	2.4940*
1965	17.16	18.26	16.72	12.32	3.7811**
1966	17.91	19.09	17.65	12.02	5.3705**
1967	19.75	20.78	19.89	13.38	4.8172*
1968	21.50	22.50	21.64	15.40	3.0557*
1969	24.87	25.70	24.98	19.80	1.5019
1970	30.50	31.91	28.95	27.44	.8227
1971	33.74	35.99	29.95	32.97	1.6098
1972	33.27	34.42	31.44	32.53	.7418
1973	36.11	37.36	34.01	35.71	.6184
1974	42.86	43.53	39.45	49.82	1.7330
1975	38.12	39.02	34.80	43.55	1.9969*-

**: significant at 5% level
*: significant at 10% level
*-: significant at 15% level

Table III

Average value of $\frac{D}{A}$ and the F statistics

	$\frac{\bar{D}}{A}$				F statistics
	Overall	Group 1	Group 2	Group 3	
1958	45.60 (47.29)	45.72	45.98	43.71	.5255
1959	45.09 (47.06)	45.01	45.76	43.42	.8313
1960	44.89 (46.43)	45.01	44.90	44.19	.1004
1961	45.22 (47.04)	45.43	45.61	42.83	1.0352
1962	44.33 (45.65)	44.32	44.56	43.69	.0917
1963	43.71 (45.50	43.34	44.45	43.42	.2870
1964	43.30 (45.39)	43.19	43.73	42.53	.1691
1965	42.97 (45.60)	43.21	43.07	41.28	.4060
1966	43.41 (46.95)	43.47	44.40	39.97	1.3751
1967	43.86 (48.14)	43.30	45.25	42.67	.6495
1968	44.74 (49.68)	44.85	45.75	40.95	1.3953
1969	44.84 (50.70)	45.09	45.10	42.65	.4807
1970	46.76 (51.29)	46.28	47.10	48.40	.7256
1971	46.79 (51.09)	46.74	46.97	46.51	.0480
1972	45.55 (50.33)	45.07	46.41	45.48	.6324
1973	44.80 (49.81)	44.35	45.14	46.34	.6162
1974	42.66 (46.53)	43.25	42.73	43.00	.3595
1975	43.75 (48.19)	44.01	43.03	44.54	.5897

APPENDIX A

Firms Included in the Sample
(According to Rate Base Method)

Original Cost

Bangor Hydro-Electric Co.	Boston Edison Co.
Central Hudson Gas & Electric	Central Louisiana Electric Co.
Central Main Power Co.	Consumer's Power Co.
Concord Electric Co.	Detroit Edison Co.
Consolidated Edison Co.	Edison Sault Electric Co.
Green Mountain Power Corp.	Fitchburg Gas & Electric
Long Island Lighting Co.	Florida Power & Light
Maine Public Service	Florida Power Corp.
New York State Electric & Gas	Hawaiian Electric Co.
Niagra Mohawk Power Corp.	Kansas Gas & Electric
Orange & Rockland Utilities	Kansas Power & Light
Pacific Gas & Electric	Madison Gas & Electric
Public Service Co. of Colorado	Savannah Electric & Power Co.
Rochester Gas & Electric	Tampa Electric
San Diego Gas & Electric	Upper Penninsula Power Co.
Southern California Edison	Wisconsin Electric Power Co.
United Illuminating Co.	Wisconsin Power & Light

APPENDIX A
(continued)

Fair Value

Arizona Public Service Co.

Duquesne Light Co.

Pennsylvania Power & Light Co.

Public Service Electric & Gas Co.

Tucson Gas & Electric Co.

Atlantic City Electric Co.

Central Illinois Light Co.

Central Illinois Public Service Co.

Commonwealth Edison Co.

Illinois Power

Indianapolis Power & Light Co.

Louisville Gas & Electric Co.

Missouri Utilities Co.

Philadelphia Electric Co.

Public Service Co. of Indiana

Public Service Co. of New Mexico

St. Joseph Light & Power

Southern Indiana Gas & Electric Co.

UGI Corporation

Reproduction Cost

Cincinnati Gas & Electric Co.

Cleveland Electric Illuminating Co.

Columbus Southern Ohio Electric Co.

Dayton Power & Light

Ohio Edison

Toledo Edison

Appendix or Data Summary

1. Total operating revenue for firm i = PQi; data obtained Moody's Public Utility Manual [MPUM].
2. Total variable cost for firm i = VQi; data obtained from MPUM.
3. Total fixed cost for firm i = Di; data obtained from MPUM.
4. Total returns for firm i = Xi; this variable was defined to be net operating revenues plus taxes. Data from MPUM.
5. Total interest charges for firm i = Fi. It was defined to be interest or long-term debt plus other interest charges. Data from MPUM.
6. Total long-term debt (or total debt) of firm i = Di. The book value of long-term debt (or total debt) for firm i. Data obtained from MPUM.
7. Total assets for firm i = Ai. The book value of assets for firm i. Data obtained from MPUM.
8. Rate base methods were validated by referring to 5 different sources to asure that the correct rate base method was used in this study. This information was obtained from Eiteman (1962), Pike (1967), Phillips (1969), and Senate Document No. 56, 90th Congress 1st Session <u>State Utility Commissions Summary and Tabulation of Information Submitted by the Commissions</u>, and State of Arizona, <u>Arizona Corporation Commission Annual Report</u> (1970).

FOOTNOTES

[1]Rates of return are generally determined by the cost of capital. See Peterson (1976) for details. The regulatory process specifies relevant costs and expenses which may be recovered by the utility firm as services are priced to the buyer. The revenue requirement, that is the revenue that the utility is authorized to collect, may be defined as follows. See Garfield and Lovejoy (1964, p. 44).

(1) Revenue Requirement = cost of service

(2) $RR = E + d + T + (V-D)R$

where: RR = revenue requirement
E = operating expense
d = depreciation expense
T = taxes
V = gross valuation of the property serving the public
D = accrued depreciation
R = rate of return (a percentage)
$(V-D)$ = rate base (net valuation)
$(V-D)R$ = return amount, or earnings allowed on the rate base.

[2]These results are expected from theory and confirmed by Eiteman (1962, p. 39).

[3]This effect is consistent with Modigliani and Miller (1958, pp. 261-97).

[4]Figure 1 adapted from Hurdle (1974, p. 479). In analyzing leverage, diversification and capital market effects on risk-adjusted capital budgeting, Tuttle and Litzenberger (1968, pp. 428-29) have argued that the firm does have the option of neutralizing the risk inherent in a given investment opportunity through long-term borrowing or lending.

[5]In Tables I-III, group 1 = original cost regime; group 2 = fair value regime, and group 3 = reproduction cost regime.

[6]As the DOL is derived from the concepts of cost-volume-profit (CVP) and Break-even analyses and the CVP and Break-even analyses are concerned with short-run analyses. However, the AJ type analysis is based upon long-run analysis. Adar, Barnea, and Lev (1977)'s comprehensive CVP analysis has analyzed the economic implications of CVP and break-even analyses.

[7]Hite (1977) has shown that cost of capital need not decline with leverage even in perfect capital markets and with default-fee debt. This finding may be used to justify why differed regulation regimes affect the capital structure in some years and not in other years.

[8]They use this definition to show that the higher the marginal corporate tax rate and degree of leverage, the smaller the variance in after tax revenue.

[9]See Scanlon (1972) for detail.

[10]A more liberal regulation will generally increase a firm's total returns.

Firms Included from Modligliani and Miller Sample
as used by Boness and Frankfurter
(Classified by Rate Base Method)*

Firms From Original Cost Jurisdictions

Boston Edison	Niagara Mohawk Power
Central Hudson Gas & Electric	Oklahoma Gas & Electric
Consolidated Edison	Pacific Gas & Electric
Consumers Power	Public Service of Colorado
Detroit Edison	Rochester Gas & Electric
Florida Power	San Diego Gas & Electric
Florida Power & Light	South Carolina Electric & Gas
Idaho Power	Southern California Edison
Kansas Gas & Electric	Utah Power & Light
Montana Dakota Utility	Virginia Electric & Power
N.Y. State Electric & Gas	Wisconsin Electric Power

Firms From Fair Value Jurisdictions

Atlantic City Electric	Indianapolis Power & Light
Carolina Power & Light	Kansas City Power & Light
Central Illinois Light**	Louisville Gas & Electric
Central Illinois Public Service**	Pennsylvania Power & Light
Commonwealth Edison	Philadelphia Electric
Duke Power	Public Service of Indiana
Illinois Power**	Duquesne Light Co.

Public Service Electric & Gas

Firms Included from Modligliani and Miller Sample
as used by Boness and Frankfurter
(Continued)

Firms From Reproduction Cost Jurisdictions

Cincinnati Gas & Electric	Dayton Power & Light
Cleveland Electric	Ohio Edison
Columbus & S. Ohio Electric	Toledo Edison

*Texas companies are not listed because, in that state, utilities are regulated at the local levels and no state regulation exists. Other firms were not included if the rate base method in their state could not be established without ambiguity.

**Illinois firms are classified as fair value firms even though that state used original cost methods since March 13, 1973. This procedure was followed because the interval is rather short and it is unlikely that substantial modifications occurred since the change.

REFERENCES

[1]Adar, Z., A. Barnea and B. Lev (1977). "A Comprehensive Cost-Volume-Profit Analysis Under Uncertainty," The Accounting Review, LII, pp. 137-149.

[2]Averch, H. and Johnson, L. L. (1962). "Behavior of the Firm Under Regulatory Constraint," American Economic Review, 52, pp. 1053-1069.

[3]Boness, J. A. and G. M. Frankfurter (1977). "Evidence of Non-Homogenuity of Capital Costs Within 'Risk Class'," Journal of Finance, 32, 2.

[4]Eiteman, D. K., (1962). "Interdependency of Utility Rate-Base Type, Permitted Rate of Return, and Utility Earnings," Journal of Finance, Vol. 17, pp. 38-39.

[5]Garfield, P. J. and W. F. Lovejoy (1964). Public Utility Economics, Pren-Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

[6]Hite, G. L. (1977). "Leverage, Output Effects and the M-M Theorems," Journal of Financial Economics, 4, pp. 177-202.

[7]Hunt, P. (1961). "A Proposal for Precise Definition of 'Trading on the Equity' and 'Leverage'," Journal of Finance, 16, pp. 377-386.

[8]Hurdle, Gloria G. (1974). "Leverage, Risk, Market Structure and Profitability," Review of Economics and Statistics, Vol. LVI, No. 4, pp. 478-485.

[9]Krainer, R. E. (1977). "Interest Rates, Leverage, and Investor Rationality," Journal of Financial and Quantitative Analysis, 12, pp. 1-31.

[10]Mao, J. C. T. (1969). Quantitative Analysis of Financial Decision, The MacMillan Company: New York.

[11]Modigliani, F. and M. H. Miller (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, Vol. XLVIII, pp. 261-97.

[12]Modigliani, F. and M. H. Miller (1963). "Corporate Income Taxes and the Cost of Capital: A Correction," American Economic Review, Vol. LII, pp. 433-43.

[13]Modigliani, F. and M. H. Miller (1965). "The Cost of Capital Corporation Finance and the Theory of Investment: Reply," American Economic Review, Vol. LV, pp. 524-27.

[14]Miller, M. H. and F. Modigliani (1966). "Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954-58," The American Economic Review, Vol. LVI, pp. 333-391.

[15]Petersen, H. C. (1976). "The Effect of 'Fair Value' Rate Base Valuation in Electric Utility Regulation," Journal of Finance, Vol. XXXI, pp. 1487-1490.

[16]Pike, J. (1967). "Residential Electric Rates and Regulations," The Quarterly Review of Economics and Business, Vol. 7, pp. 45-52.

[17] Phillips, C. F. Jr. (1969), The Economics of Regulation, revised edition (Homewood: Richard D. Irwin, Inc.).

[18] Scanlon, J. J. (1972). "Bell System Financial Policies," Financial Management (Summer 1972), pp. 16-26.

[19] Scott, J. H. Jr. (1977). "Bankruptcy, Secured Debt, and Optimal Capital Structure," Journal of Finance, 32, pp. 1-19.

[20] Tuttle, D. L. and R. H. Litzenberger (1968). "Leverage, Diversification and Capital Market Effects on a Risk-Adjusted Capital Budgeting Framework," Journal of Finance, 23, pp. 427-43.

[21] Weston, F. and E. F. Brigham (1975). Managerial Finance, The Dryden Press, Hinsdale, Illinois.